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SURVEY OF UNIT PERFORMANCE EFFECTIVENESS MEASURES

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Naval Personnel Research and Development Center
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Improved measures of performance effectiveness are required by the Marine Corps for its combat unit training program in order to ensure the maintenance of appropriate levels of unit readiness in accordance with its assigned mission.

A survey to determine the state-of-the-art of performance assessment systems and methodologies was conducted as an initial research phase in support of this requirement. A two-fold effort was made to review the research literature in such areas as performance evaluation, decision making, and unit training, and to gather first-hand information about existing performance assessment systems.

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This broad informational survey provides a number of alternative theoretical and practical methodologies which may serve as feasible approaches in ensuing research.

SUMMARY

Background

This research was conducted as the initial phase of a research project in support of a Marine Corps requirement for improved unit and individual performance measures to be used in conjunction with the Tactical Warfare Analysis and Evaluation System (TWAES). TWAES is a computer based system designed to improve the control and evaluation aspects of Marine Corps field exercises. A survey of existing performance assessment systems and methodologies was deemed necessary prior to initiating research approaches in this area to insure that a wide range of viable alternatives would be considered.

Approach

A simultaneous effort was initiated to review the literature in the field and to determine the state-of-the-art of existing performance evaluation systems. Observation of Marine Corps field exercises and examination of related U. S. Army systems were conducted along with an in-depth review of such literature areas as unit and individual performance, performance evaluation, decision making, and training.

Discussion

Participation in a Marine Corps Brigade level field exercise and observation of subsequent unit debriefings involving the use of TWAES revealed a number of areas requiring research support to maximize existing and planned TWAES functions. Areas which appear to require support efforts include the timely reporting and assessment of events by umpire personnel, the structure and nature of the post-exercise debriefing, and the content of data printouts supporting the debrief. Observations of the Modern Army Selected System Test Evaluation and Review System (MASSTER) indicated that it shares similar field performance evaluation problems with TWAES although the two systems have different basic objectives. One of the most significant differences between the systems for purposes of this research is that TWAES operates in real time whereas MASSTER does not.

The research literature overall is not consistent and substantive in the performance areas of importance to TWAES. The literature contains numerous references to performance evaluation systems designed for highly specific situations, but these generally are neither sufficiently objective nor compatible with field environments. The more objective approaches involve sophisticated statistical techniques and/or extensive simulation efforts. There are some subjective techniques for deriving human performance predictors and criteria which may be relevant. Among these, the Delphi technique--a systematic means of extracting expert opinion--appears to be adequately qualified in terms of validity and practicality for application to TWAES.

Considerable information on personal backgrounds, attitudes, and physiological measures is available, but does not appear to be of immediate utility to TWAES. Conversely, the relatively more sparse literature on organizational, situational, and evaluative factors appears to be more readily applicable to TWAES requirements.

Conclusions and Recommendations

The literature does not contain substantive research studies defining human performance assessment methods and criteria suitable for direct application to TWAES. The literature does, however, contain studies that will be of use in initiating and structuring the research in this area. Organizational, situational, and evaluative factors all hold promise as potential sources of performance effectiveness measures along with the use of Delphi-type approaches for the development of interim methods and criteria.

CONTENTS

SURVEY OF UNIT PERFORMANCE EFFECTIVENESS MEASURES

I. Background

This survey investigation was conducted as an initial phase of a research effort undertaken in support of a Marine Corps requirement for improved unit and individual performance measures to be used with the Tactical Warfare Analysis and Evaluation System (TWAES). TWAES is a computer-based system designed to improve control of Marine Corps field exercises and thereby improve the training engendered by the exercises. Considerable informative feedback from field exercises is processed and available for playback by TWAES, but new evaluation approaches and criteria are needed to provide meaningful assessment of performance to the trainers. Improved measures of effectiveness and performance standards for field units would provide estimates of combat readiness and provide the basis for the establishment of training objectives. An informational survey was needed as a research prerequisite in order to determine the state-of-the-art with respect to existing assessment systems and methodologies so that decisions regarding the appropriate research approaches could be made with knowledge of feasible alternatives and research options. To the extent that the present research problem is representative of a broad range of other criterion and measurement problems, the present survey should provide specific data and general information of value in solving similar problems in other contexts.

II. Approach

A two-fold approach was used to determine the personnel research requirements needed to support the TWAES in the evaluation of individual and unit performance. A concurrent effort was undertaken to review the literature in the area and to determine the state-of-the-art in existing related systems. The approach taken in these two efforts is described below.

A. Technical Search

The development of the specialized expertise required for the conduct of the TWAES project was accomplished through the following efforts: involvement in Marine Corps field exercises; detailed examination of similar existing systems; and attendance at and participation in technical conferences pertinent to the technical requirements of TWAES. Additional information was collected through interviews with cognizant Marine Corps personnel and with personnel from the Naval Electronics Laboratory Center (NELC), San Diego, who are assigned to hardware and software aspects of the system.

B. Literature Search

The basic sources of the literature survey were psychological abstracts (1963-1972) and Defense Documentation Center bibliographic searches. Additional sources included publications from military and civilian research

centers. Topic areas included such obviously relevant areas as unit and individual performance, performance evaluation, decision making, and training. Also included were a number of less directly related topic areas such as economic and technological forecasting in order to include coverage of secondary aspects of the problem area and to insure that potentially critical factors were not overlooked.

The results of the literature survey are presented in narrative form in the body of the report and also as an annotated bibliography. The narrative references in the body of the report are necessarily terse and provide only an indication of the general topic area. A more complete description of the methodologies and results of each report is provided by referring to the annotated bibliography. Although a number of studies were found to be relevant to military performance evaluation in general, the available literature on individual and unit performance evaluation methodologies directly applicable to the requirements of TWAES is limited. There is a particular shortage of objective, quantitative methodologies available for application in field exercise environments. For the purposes of this summarization, the available performance related literature was broken down into six performance related areas: Evaluation, Simulation, Training, Situational Factors, Organizational Factors, and Biographical Factors. The area of Evaluation is concerned with methodologies and techniques for standardizing and evaluating human performance both individually and in groups. The Simulation literature contains studies on war-games, strategy selection, equipment simulators, and attempts to validate war-game and battle simulations against historical combat performance data. The Training references refer primarily to the effects of various training strategies on eventual performance and the development of training courses. The Situational area contains references to work related situational stress, fatigue, informational load, and isolation factors. This area also has considerable data relating to decision making. The Organizational area contains research on group structure, interaction patterns, management, and leadership factors that affect performance. The Biographical area contains studies on anxiety, personal history, and physiological factors which are predictive of performance, primarily at the individual level.

III. Discussion

A. Technical Search

1. TWAES. Pursuant to the requirements of the TWAES project, personnel from this Center acted as observers in a Marine Amphibious Brigade Landing Exercise (MABLEX) at Camp Pendleton in January 1973. During this exercise and during discussions with Marine Corps personnel, note was made of several problems associated with the use of TWAES in field exercise environments. Difficulties were noted in the lack of timely reporting of events via the Digital Message Entry Devices (DMED) in certain situations and in the accurate assessment of performance events by umpire personnel. Part of the total problem is associated with technical aspects of the equipment and is, therefore, not primarily within the area of

research responsibility of the Navy Personnel Research and Development Center (NPRDC). Another part of the problem derives from the difficulty inherent in the measurement of complex human performance in a field environment.

Additional areas of difficulty were noted in the post-exercise debriefing session. The training related aspects of the interaction between the unit staff being debriefed and the controllers performing the debrief require further definition. This will be required, in part, to determine whether the debrief should be an integral part of the exercise, and as such is basically a training vehicle, or whether it is in fact a "post-exercise" debrief and as such is simply an informational briefing following the exercise. If the purpose of the debrief is training, there must be either implicit or explicit evaluative judgements concerning the events and decisions which occurred during the exercise. That is, the training function requires recognition of criterion goals in order that the desired behavior or skills will be engendered by the exercise. The debriefing in turn, may then provide an additional opportunity for evaluating unit and individual performance data that may have been overlooked during the actual exercise. If the debrief is not intended as a part of the training exercise phase, its structure can be modified accordingly.

Another aspect amenable to improvement is concerned with the TWAES computer data printouts and with the application of those printouts to the debrief activity. Presently the content of these printouts is composed almost entirely of the data that are needed to control and monitor the field exercise rather than data designed for performance evaluation purposes. As a consequence, the printouts do not readily support the debrief activity. This problem is further confounded by the need to determine whether the printouts should support the debrief per se or should be for use by the unit commanders in preparing future training plans. In short, a determination must be made of what is needed by whom and at what time.

The environment inside the TWAES control van during the exercise is conducive neither to operational effectiveness nor personal comfort. Very high noise levels were in evidence during the January 1973 MABLEX. This appeared to be the result of unsquelched communications sets being operated with speakers, and also due to controllers having to share or cross-utilize communications sets.

The questions of where and how unit performance data should impact on the TWAES system also requires careful consideration. The data might be impacted in real time by means of the DMFDs. If so, additional codes for the DMEDs may be required. Additionally, if the data were to impact in real time on the TWAES firepower models and calculations, suitable modifications of those models would have to be coordinated with NELC personnel. It is highly desirable that the data impact in real time and in the firepower calculation so that troop performance will have an effect on the outcome of every battle during an exercise. If this is accomplished the "reward" for a high level of performance during an exercise and during actual combat will be more similar than at present.

If the data were not to impact in real time, means of entering the data into the system periodically, or perhaps only at the debriefing, would have to be developed. This alternative is less desirable than the former, but would be easier to accomplish and may be necessary as an interim measure.

2. MASSTER Modern Army Selected System Test Evaluation and Review (MASSTER) at Fort Hood, Texas, performs equipment, organizational structure, and concept testing for the U. S. Army. A review of that system indicates that it shares certain evaluative problems, if not features, with TWAES. MASSTER attempts to evaluate weapons systems by employing a combination of checklists, associated logic trees, and expert judges in the field environment.

The checklist-logic tree evaluation utilizes field observers to check off the units' performance in specified situations. The list is inherently weighted by the design of the logic tree and a unit passes or fails progressively larger performance tests as a result of their performance at the individual and small unit level in building block fashion. MASSTER also assigns officers to subjectively evaluate large units during an exercise. These officers must meet certain experience requirements, including having commanded a similar unit, before being selected for these assignments. Typically, these are senior field grade officers. These officers, used as expert judges, are authorized to overrule the results of the checklist evaluation if they feel it necessary. While MASSTER planners would prefer the system to be more objective and quantitative, they feel the state-of-the-art requires this compromise at the present time.

Data from MASSTER is not reported on a real-time basis. Rather, it is collected daily in the form of booklets and is analyzed after the exercise is completed. In some cases, a period of several months elapses before the analysis is completed. This time lag is compatible with the purposes of MASSTER but it would not be acceptable for TWAES purposes.

B. Literature Search

1. Evaluation. The research literature in the performance evaluation area, although variable in quality, contains a number of methods of potential utility for TWAES research. The literature of interest includes the areas of peer and supervisor performance evaluation, observer checklist evaluations, multivariate analysis approaches, and subjective evaluation techniques involving Delphi.

Research reported by Nelson and Berry (1966) indicated that peer and supervisor evaluations tend to reflect different abilities. Supervisors' ratings of military personnel tend to measure the individual's technical competence whereas peer ratings tend to measure adherence to organizational guidelines. Lackey, Olmstead, and Christensen (1972) found that battalion commanders and company commanders have differing expectations as to how officers in each of those positions should exercise leadership. These

findings have ramifications for performance evaluation during field exercises to the extent that these role expectations and criteria differ at the two different leadership levels.

There are a number of performance evaluation methods that have been designed for specific applications. Among these is a study by Dunlap and Associates (1966) that was conducted for the Army in the area of chemical warfare. This effort was concerned with team testing techniques and focused on recording observable behavior and team interactions. No direct measures of mission success were incorporated in the study. This type of study does, however, have relevance for TWAES. Additional team testing methods for use with armored units are reported by Cook and Baker (1968) who divided evaluation into three areas: individual, squad and section, and intact platoon. Engel (1970) also has reported work with classificatior systems in the area of performance assessment. Linder, Smith, Grover, Morrissey, and Allen (1969) have reported on performance measurement techniques for use with individuals in combat situations. This report also contains a discussion of the requirements necessary for performance evaluation that is relevant to TWAES requirements. All of these studies have at least tangential impact for TWAES.

A report by Chesler (1971) presents a broad methodological approach for development of computer-assisted evaluation of trainee performance in a simulation environment. The research emphasized Navy anti-air warfare instruction, but may have applications to other computer-based training environments. A further report by the same author (1972) summarizes the previous work and, additionally, describes in detail an attempt to automate the collection of performance data and also details the problems inherent in allowing hardware development to proceed ahead of consumer utilization procedures.

Research reported by McQuire (1968) concerning the determination of success related combat factors, appears of considerable potential importance to TWAES. This research used a multivariate statistical analysis of past combat engagements to factor out relevant criteria which in turn can be stressed and observed in field exercises. This is one of the few attempts to validate performance criteria against real combat data. In another study by Prunkl and Boyles (1968), 62 Vietnam returnees were studied to gain data on effective and ineffective aerial combat performance.

The use of Delphi related techniques to derive unit performance criteria appears to be of considerable value in meeting initial TWAES requirements. Research by Dalkey (1968), Helmer (1967), and Beach (1972) all provide methodologies and experimental information applicable to the measurement aspects of TWAES. The Delphi technique--a systematic technique for the extraction of expert opinion--may be used to extract subjective indicators of unit performance from senior Marine Corps personnel. These indicators, after further identification and definition by the Delphi process, could then be used in field exercises by less experienced evaluators.

2. Simulation. Insight into the factors contributing to successful combat performance has been facilitated by simulation technology. While the TWAES program itself is not a simulation, the following studies are included to provide a general overview of simulation related performance measures in an attempt to indicate those measures of effectiveness which might be more extensively examined through simulation.

Dalkey (1967) discussed simulations developed by the Rand Corporation and presented the common characteristics of simulations. This article also detailed four uncertainties of weapons systems analysis (stochastic; epistemic; strategic; and axiological) that may be of use in TWAES related research. The human factors input to simulation systems was studied by Arima (1969). Arima contended that it is doubtful that an experimental weapon system evaluation can duplicate the conditions of real combat. In essence, it is difficult to motivate individuals to perform realistically, so incentives and rewards are offered as alternatives to increase authenticity. But even the best "training" incentives are different than, and probably have much less impact than, the incentives/punishments of combat. The individual is also the focus of a paper by Baker (1972) where a simulation is proposed that would yield measures of system performance under different mixes of equipment, personnel, and procedures.

Another simulation model was provided by the U. S. Army Institute of Advanced Studies (1967) in which a combat model for maneuver and firepower analysis was described. Although unit effectiveness was not discussed directly, Feldman and Simon (1970) described a study in which data from an actual battle were compared with data from the same battle simulated on a computer. The number of people killed in action was not significantly different between the actual and simulated exercise, thereby providing one measure of the validity of the simulation.

The evaluation of leader effectiveness is an involved process as is shown in a simulated combat study by Helme, Willemin, and Grafton (1971). The contribution of this particular study stems from the success of the simulation tasks in identifying specific behaviors descriptive of leaders in combat. The input of various leader variables does not, however, appear to be particularly useful for TWAES at this time.

3. Training. The performance of a unit during an exercise as evaluated by TWAES and the unit commander is in a practical sense an indication of previous training program effectiveness. The following studies present information relating to attitudes during training, to training program requirements and methodology, and to transfer of training.

A study by Clum, Hoiberg, and Kole (1969) showed that attitudes toward the military and toward superior officers (Marine) changed in a negative direction during recruit training. Conversely, a study by Wilkins (1967) found that a Marine recruit's opinion of the Corps improved during training. Olmstead (1968) studied 824 basic rifle marksmanship trainees and concluded that "quick-kill" training increased trainee confidence in the firing of their weapons. This study did not, however, measure actual firing performance.

A paper by Hahn and Dayton (1967) presents technical training evaluation data and techniques developed around U. S. Marine Corps courses. Methodologies for the identification of the relationship of training equipment requirements to the requirements of the training program are discussed by Smith (1965).

A number of studies were found that provided training methodologies and experimental evidence of successful performance-related training programs. A recent investigation by Wheaton, Mirabella, and Farina (1971) showed that training system requirements could be quantified. An extensive review of the learning, retention, and transfer literature as it pertained to military training was presented by Blaiwes and Regan (1970). Hallström (1969) suggested that actual combat performance could be predicted from performance exhibited in training. This work was based on an attempt to replace the concept of morale with auxiliary concepts, and is of potential importance to TWAES. George (1967) showed that coordinative responses within rifle squads, which are usually learned in combat, could be learned in training if responsibility for coordinated action were taken by unit members rather than by the unit leader.

The studies reviewed in the area of training provide a number of approaches of potential value for the purposes of TWAES.

4. Situational Factors. While one of the purposes of TWAES is to determine potential combat performance from field exercise performance, a thorough knowledge of situational variables offers insight as to what moderates this performance. The following studies provide information in the areas of performance under stress, confinement, continuous operations, and decision-making.

Streufert and Streufert (1972a) under contract to the Office of Naval Research, presented results from a study concerned with information processing under Truel stress (conflict among three parties without coalition formation). It was shown that Truel stress subjects believed they had received more information than they could meaningfully respond to, even though actual relevance of the information did not increase. The practical implications of these findings are important. Increased perception of relevance under these conditions not only produced decreased performance quality, but also increased the probability of responding to meaningless information (since more information is viewed as requiring more responses). Threat oriented and task oriented subjects were studied under high arousal levels by Bergstrom and Arnberg (1971), who found that the performance of threat oriented subjects decreased more rapidly than for task oriented subjects.

Although the probability is low that an individual or unit would be called to combat performance immediately after release from confinement and isolation, the effects of these conditions upon performance are noteworthy. Smith and Haythorn (1972) studied 56 naval enlisted males in groups of twos and threes under conditions of isolation and confinement for a period of 21 days. In general, the data suggest that performance

would vary as a function of the changes in behavior manifested by the isolated subjects and their subjective reactions to both their physical and social environment.

Since combat units periodically participate in continuous operations the following results from research studies concerning sustained performance are of relevance to TWAES. Hodge (1972) presented a series of papers that discuss the task, environmental, and nutritional variables affecting man's ability to perform for long periods of time. Harris and O'Hanlon (1972) reviewed 113 studies in an attempt to predict behavioral and biological impairments which might result from continuous operations and to determine whether the period necessary for recovery following a sustained operation could be ascertained. While their objectives were not fully achieved by the investigative review, the data did suggest that severe impairments may be experienced by soldiers engaging in continuous operations. A field experiment with tank-crews by Ainsworth and Bishop (1972) showed that continuous 48-hour operations can be accomplished without changes in existing unit organization or doctrine. Banks, Steinberg, and Farrel (1970) found similar results in a study with military personnel engaged in a 44 hour continuous operation.

Extensive experimentation has been conducted by Streufert and Streufert (1968b, 1970, 1972b) in the area of decision-making. They have demonstrated that risk-taking increases with the length of time the decision-making group spends on a task. Furthermore, risky decision-making becomes concentrated in one decision area at a time, even though risks could be taken in more areas. Results from an experimental simulation by Streufert and Streufert (1968a) also indicated that risk-taking increased with continued participation in a decision-making task and that optimal decision-making quality occurred at loads of 10 or 12 independent items received by decision-makers per one-half hour.

5. Organizational Factors. An examination of the organizational factors literature, as referenced in the Appendix, confirms the assumption that the performance of a group is a function of various organizational variables (Davis, 1969). The literature review in this area indicates that leadership, group processes, productivity, structure, and the work environment itself are of relevance to TWAES.

For example, Lange (1967) described studies which indicated that the leader is the most important variable in terms of facilitating performance. Bons, Bass, and Komorita (1970) found that leadership style will change as a function of command and previous type of command experience. O'Brien (1970) in a study with Australian Army soldiers, reported that leader effectiveness depends upon: (1) the personal attributes and rank of the leader; (2) the quality of leader-member interpersonal relations; and (3) the kind of group task.

The latter two variables were examined by Springer (1971) in a study of military basic trainees and platoon drill sergeants. It was shown that there is sometimes a difference between the attitudes of superiors

and subordinates toward the legitimacy of supervisory influences under certain conditions and that these differences seem to be related to the work environment. Also, in reference to attitudes, a study by Nelson (1968) reported that the cohesiveness of Marine basic training platoons was relatively stable over a two month period, but it was uncorrelated with performance measures, although it was related to personnel composition and attitudes.

A number of studies indicated that an understanding of performance can be facilitated when consideration is given to certain group variables. The individuals that compose a group will often vary in their conceptual level with subsequent variations in structuring, functional role certainty, and decision-making as was shown by Stager (1966). O'Brien (1970) also showed that the group task affected the nature of the perceived group interaction, group productivity, and leader effectiveness.

Additional research in decision-making processes was done by Cockrell (1969). Results from that study showed that team consensus feedback enhances target detection in field units. Stager (1965) also studied decision-making and showed that the cognitive complexity of a group determined the mode of operation of the group.

The research evidence indicates that organizational factors do impact on performance in military units. To the extent that contributory factors can be identified and reliably measured under field exercise conditions, they may provide useful performance measures for TWAES.

6. Biographical Factors. The general area of biographical factors contains references on intelligence, anxiety, personal history, and physiological factors which may impact on performance. Among the studies referring to leadership in this area are findings by Csoka and Fiedler (1972) that indicate that the correlation between leader intelligence and group performance is low.

Most of the studies relating anxiety to performance have only marginal relevance to immediate TWAES requirements. Research by Clum and Mahan (1971) and Datel and Lifrak (1969) was conducted on basic training recruits. Studies by Bourne, Coli and Datel (1968) and Strange (1968) were conducted in combat environments but their results are clinically oriented and not of apparent relevance to TWAES. Similarly, personal history studies relating to performance such as those by Berry and Nelson (1966) and Mahan and Clum (1971) are of primary value in terms of personnel selection systems. The physiological studies by Arthur (1971); Carver and Winsmann (1970); and Srivastava (1968) are concerned with performance only from a medical point of view. In summation, those biographical factors reviewed do not provide sources of performance measures or predictors readily applicable to Marine Corps requirements on TWAES.

IV. Conclusions and Recommendations

While the literature does not provide the well-defined and uniform coverage of individual and unit performance measures needed to support

TWAES, it does contain studies from many areas that are of value as points of departure for further research. For example, the literature concerning situational and organizational determinants of performance appear particularly relevant to the requirements of TWAES. The differential effects of situational variables and their interaction with organizational variables may provide one valid conceptual basis for developing measures of effectiveness.

Literature from the training area contains studies on the evaluation of morale through the use of auxiliary concepts and also provides pertinent studies on the evaluation of unit coordination. Both of these areas have potential application to TWAES. Further research into the warfare simulation area also appears warranted. The large amount of data that can be rapidly generated and the wide range of potential predictor variables that can be simultaneously manipulated make this an area of importance. Delphi approaches are indicated in the evaluation literature to be reliable initial sources of performance measures. As an interim method, the Delphi approach appears to be acceptable in terms of both theoretical and practical considerations. For the long term, these subjective methods would be supplanted by more sophisticated quantitative measures as they are developed and validated. Observations of MASSTER at Fort Hood, Texas, confirm this view. MASSTER utilizes a large subjective element in its evaluative process at present to complement its objective procedures, not by choice, but rather by necessity. More objective techniques will be utilized as they are developed and validated. In the interim, however, MASSTER combines both subjective and objective techniques to utilize the strengths of each in meeting an immediate requirement.

In summation, the available literature and existing systems, as anticipated, do not provide any ready solution to the performance evaluation requirements of TWAES. These sources do, however, provide diverse information concerning experimental methodologies, experimental results, and theoretical concepts which can be utilized in the development of effectiveness measures and procedures for TWAES.

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   The study contains a description of an importance allocation procedure. Importance rather than utility of outcome was found more useful. ". . . this model can help judges produce a coherent hierarchy of related outcome with attendant importance weights by breaking the judgement tasks into parts and then synthesizing the judgements mechanically using the importance allocation model."

2. Chesler, David J. Computer-assisted performance evaluation for Navy anti-air warfare training: Concepts, methods, and constraints. San Diego: Naval Personnel & Training Research Laboratory, May 1971. (Research Report SRR 71-25)

   This report proposes a six-step methodological approach for computer assisted evaluation of man-machine performance as found in the Tactical Advanced Combat Direction and Electronic Warfare (TACDEW) system. The suitability of the proposed methodology is discussed in terms of applications to other areas (e.g., multi-team (CIC) anti-air warfare; carrier controlled approach; and surface maneuvers (radar navigation).

3. Chesler, David J. Application and utilization of training aids and devices: Simulated exercises and trainee performance evaluation. San Diego: Naval Personnel & Training Research Laboratory, September 1972. (Research Report SRR 73-7)

   This report presents a detailed description of an attempt to accomplish real-time performance evaluation on the Tactical Advanced Combat Direction and Electronic Warfare (TACDEW) system. The account emphasizes the numerous difficulties, both technical and administrative, inherent in attempts to apply computer-assisted evaluation techniques to complex simulation systems.

4. Cook, J. G., & Baker, R. A. Armored infantry platoon training and evaluation. HumRRO Professional Paper, 1968, No. 28-68.

   Presents research in training methods and techniques for improving combat readiness of the armored cavalry platoon. Criteria to evaluate the combat-ready status of units are established through a readiness check. A tactical training method bridging the gap between classroom and field is also described

5. Dalkey, N. C. Predicting the future. Santa Monica, California: Rand Corporation, October 1968.

Presents a description of the Delphi Method. The group is not asked to arrive at a common opinion. Rather, the group opinion is the statistical average of the final opinions of individual members of the group.

6. Dunlap & Associates, Inc. Performance measures for human factors engineering evaluation of EARL equipment. Edgewood, Maryland: Prepared for Edgewood Arsenal Research Laboratories, SSD66-332(618) June 1966.

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Presents an attitude change study. It concludes that if you let people decide if a relevant concern should be changed, you may not succeed. If, on the other hand, you let people decide how the change is to be implemented you may gain cooperation.

10. Lackey, L. L., Olmstead, J. A., & Christensen, H. E. The effect of command position upon evaluations of leader behavior. HumRRO Technical Report, November 1972, No. 72-32.

Study indicates that, "Battalion Commanders do not differentiate between command levels as to the desirability of leader actions. Company Commanders differentiate between command levels with regard to actions concerned with centralization of authority and responsibility. Company Commanders consider decentralized actions to be more desirable for both Battalion Commanders and Company Commanders than do Battalion Commanders."

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The report documents research on individual performance at combat tasks while under the effects of chemical warfare incapacitants. It contains a good discussion of experimental requirements for performance evaluation.

12. McQuire, R. Multivariate analysis of combat. Washington, D. C.: Planning Research Corporation, PRC R-1143, July 1968.

Provides a comprehensive review and application of multivariate techniques to historical combat data for the purpose of factoring out the relative contributions of maneuver and firepower to mission success.

13. Nelson, P. D., & Berry, N. H. Dimensions of peer and supervisor ratings in a military setting. USN MNRU Report, 1966, No. 66-1.

A supervisor rating on overall adjustment and peer-group nominations for routine work assignments and a hypothetical combat situation were obtained on 101 male enlisted Marines who had completed two years of military service. In studying the dimensions of such evaluations, the supervisor rating appeared to reflect primarily the S's technical competence on the job whereas the peer nominations tended to predominantly reflect S's conduct or capacity for adhering to the organization's rules and regulations.

14. Prunkl, P. R., & Boyles, Wiley R. A. A preliminary application of the critical incident technique to combat performance of Army aviators. HumRRO Professional Paper, 1968, No. 24-68.

Sixty-two Vietnam returnees completed a critical incident survey in which they described, in narrative form, their combat reaction and those of other pilots. Incidents of ineffective behavior occurring in the air and on ground were categorized using R. P. Kern's conceptual model of behavior under stress.

15. Tetmeyer, D. C. The influence of partial models and criterion measurement scales on consideration of incommensurate criterion variables in a complex decision. Dissertation Abstracts International, October 1970, 31(4-B), 2343.

16. Wolf, C., Jr. The present value of the past. Santa Monica, California: Rand Corporation, P-4067, April 1969.

This study may have importance for post exercise evaluative reviews. This approach may alter the outcome of evaluations made during the exercise based on more complete information or subsequent events.

Simulation

17. Arima, J. K. Human factors in weapon system evaluation (U). Fort Ord, California: Litton Scientific Support Laboratory, Technical Paper LSSL-TP-69-1, 1969.

The report emphasizes the need for systems under evaluation to be stressed. Care must be taken to test those elements of a system that are critical to the system being evaluated and not simply superficial characteristics of the combat situation.

18. Baker, J. D. Quantitative modeling of human performance in information systems. Arlington, Va.: Behavior and Systems Research Laboratory, Technical Research Note 232, June 1972.

Describes an information system model which focuses on man and considers the computer as a tool. Links human performance implications to system performance as cohesive systems based on the flow of data through both man and machine.

19. Dalkey, N. C. Games and simulations. Santa Monica, California: Rand Corporation, April 1964.

Presents a discussion on the application of game theory to military analysis. At the time of the report game theory was not adequate for complex tasks, and also, many military encounters are not zero-sum. The concept of imbedded models is discussed where the overall or aggregate model is used to provide inputs and control for more powerful specific models.

20. Dalkey, N. C. Simulation of military conflict. Santa Monica, California: Rand Corporation, January 1967.

The article classifies simulations according to size, formalization, and analyticity characteristics. It discusses simulations developed by Rand. Four uncertainties in weapons systems analysis are discussed: (1) stochastic--where events are probabalistic; (2) epistemic--where you don't have enough

information to make a decision; (3) strategic--where two or more independent decision makers can affect an outcome; (4) axiological--where there is no well-defined criterion or pay-off to form a basis of evaluation.

21. Danielian, J., & Stewart, E. C. New perspectives in training and assessment of overseas personnel. HumRRO Professional Paper, 1967, No. 6-67.

Simulated training was proposed as a viable means for facilitating the cross-cultural acclimation of military personnel serving overseas.

22. Feldman, L., & Simon, S. The relation of the tactical warfare simulation program (TWSP) to historical warfare. Arlington, Va.: The Center for Naval Analyses, Naval Warfare Analysis Group, Study No. 64, VIII, 1970.

Provides detailed description of the comparison of three TWSP simulations with historical accounts of the same battles. TWSP uses the Lanchester laws of attrition to predict casualties. The report does not discuss unit effectiveness.

23. Helme, W. H., Willemin, L. P., & Grafton, F. C. Dimensions of leadership in a simulated combat situation. Arlington, Va.: BESRL Technical Research Report 1172, July 1971.

The findings strongly suggest that the total simulation technique can yield not only reasonably objective performance measures taken under some degree of stress, but can also contribute to better evaluations of more enduring leadership qualities.

24. U. S. Army. Assessment of combat effectiveness, Part II--Final Report. Carlisle Barracks, Pennsylvania: U. S. Army Combat Developments Command, Institute of Advanced Studies, February 1967.

Provides a description of a combat model for maneuver and fire analysis. The model is deterministic and is designed for battalion-level engagements.

Training

25 Clum, G. A., Hoiberg, A., & Kole, D. M. Attitude change in Marine recruit training. Psychological Reports, 1969, 24(1), 311-318.

Presents a study of attitude change during Marine basic training. Attitudes toward superior officers and the military in general were generally found to change in a negative direction.

26. Blaiwes, A. S., & Regan, J. J. An integrated approach to the study of learning, retention, and transfer: A key issue in training device research and development. NAVTRADEVCEN Technical Report, August, 1970, No. IH-178.

Summarizes the approach, rationale, and results of efforts to acquire information on learning, retention, and transfer applicable to military training problems.

27. Bourne, P. G. Some observations on the psychosocial phenomena seen in basic training. Psychiatry, 1967, 30(2), 187-196.

This is psychiatric study concerned with the transition from civilian to military life.

28. George, C. E. Training for coordination within rifle squads. HumRRO Professional Paper, 1967, No. 21-67, 36-44.

Attempted to provide a basis for the design of training that would facilitate coordination of the actions of unit members by shifting some of the responsibility for coordination from leaders to the unit members themselves.

29. Gum, D. R., & Knoop, P. A. Automated input/output diagnostics for a real time Simulation Research System. USAF AMRL Technical Report, 1966, No. 66-133, v.

Report includes description of a real time simulation as a training technique. Describes automated diagnostic test programs for real time input/output section of a digital training simulation research system.

30. Hahn, C. P., & Dayton, C. M. A guide for evaluating formal enlisted technical training programs in the U. S. Marine Corps. American Institutes for Research Report, 1967, No. R67-5.

Describes a general method for evaluating technical training programs that were developed around U. S. Marine courses.

31. Hallström, A. G. Stridens psykiska verkningar. Ett försök till modell för kvantitativ uppskattning: I. (Psychological effects in combat. An attempt at shaping a model for evaluating by quantity: I.) MPI B-Rapport, October 1969, No. 35.

Describes an attempt to replace the concept of morale by measurable auxiliary concepts. The theoretical background of investigations attempting to predict likely performance in the field on the basis of troop performance in military training in peacetime is detailed.

32. Hoehn, A. J. Military training research in the engineering of training programs for technical personnel. HumRRO Professional Paper, 1969, No. 4-69.

Describes recent advances in training technology directed toward solving training and manpower problems.

33. Hunter, E. G. Training models: I. The formulation of training problems. HumRRO Professional Paper, 1966, No. 13-66, 1-8.

Examines a chronology of functions found useful in establishing and maintaining effective training programs. Problems in the formulation of military training are discussed and areas of research for increased training are suggested.

34. McClelland, W. A. HumRRO research on officer training. HumRRO Professional Paper, September 1970, No. 24-70.

This report provides an overview of research in the areas of officer training and leadership.

35. Olmstead, J. A. The effects of "quick kill" upon trainee confidence and attitudes. HumRRO Technical Report, 1968, No. 68-15.

This study attempted to determine the effects of quick-kill training on the confidence and attitudes of basic combat trainees toward various phases of basic rifle marksmanship (BRM), and to obtain information on drill sergeants' opinions of the training. BRM training with quick kill was found to increase trainee confidence in ability to fire the service weapon significantly more than BRM alone. It was concluded that quick-kill training has a positive effect on trainee confidence and attitudes.

36. Smith, B. J. Task analysis methods compared for application to training equipment development. Valencia, Penn.: Applied Science Associates, Inc., September 1965.

A "compare and contrast" study is presented on various approaches to task analysis as it applies to the identification of training equipment requirements.

37. Ward, J. S. A case study of the development of an individual combat training program. HumRRO Professional Paper, 1967, No. 21-67, 20-27.

Examines problems of the curriculum designer including (1) validation of the training program, (2) dealing with traditional subjects which are difficult to relate to an actual performance requirement, and (3) differentiation between training realism and realistic training. The development of a combat training program is outlined.

38. Wheaton, G. R., Mirabella, A., & Farina, A. Trainee and instructor task quantification: Development of quantitative indices and a predictive methodology. NAVTRADEVCEN, January 1971, Report No. 69-C-0278-1.

An exploratory study was undertaken as part of a program to develop quantitative techniques for prescribing the design and use of training systems. A combination of task and training indices were found to predict later performance.

39. Wilkins, W. L. Attitudes and values as predictors of military performance. USN Medical Neuropsychiatric Research Unit Report, 1967, No. 67-6, 276-282.

Reports outcomes of the study of attitudes of Marines in basic training as related to later ratings of military adaptation. Results indicate that a Marine Corps recruit's judgment of the Corps goes up during recruit training. Attitude items related to the rise in opinion are the recruit's appreciation for the training instruction, the discipline enforced, and the mutual respect shown by the officers and men. It is concluded that via such an atmosphere, a majority of young men undergo a "dramatic, although not necessarily permanent, reformulation of life goals and values."

Situational Factors

40. Ainsworth, L. L., & Bishop, H. P. Effects of 48 hours of sustained field activity on tank crew performance. Proceedings of the Annual Convention of the American Psychological Association, 1972, 7(Pt.2), 625-626.

In a field experiment to determine effects on tank-crew performance in communication, driving, surveillance, gunnery, and maintenance tasks of sustained activity, it was shown that continuous 48-hour operations can be accomplished without changes in unit organization.

41. Banks, J. H., Steinberg, J. J., & Farrell, J. P. Effects of continuous military operations on selected military tasks. BESRL Technical Research Report, 1166, AD 718253, December 1970.

It was shown that properly motivated soldiers can perform at a stable level with no loss in efficiency on combat related tasks during a 44-hour period of continuous military operation.

42. Bergstrom, B., & Arnberg, P. The effect of threat- and task-oriented attitude upon performance under stress. Scandinavian Journal of Psychology, 1971, 12(1), 14-20.

Tracking performance and arousal level were studied in 30 Army conscripts who were threatened with electric shocks. Results showed that performance deteriorated more for Ss who were threat-oriented.

43. Boyles, W. R. Background and situational confidence: Their relation to performance effectiveness. HumRRO Professional Paper, 1968, No. 22-68.

Inventories designed to measure confidence in dangerous situations were administered to 3000 potential United States Army aviation warrant officers. Relationships of scores on two inventories (background activities, and situational confidence) to peer ratings, attrition during flight training, and accident information, are presented.

44. Farris, W., & O'Hanlon, J. F. A study of recovery functions in man. U. S. Army Human Engineering Laboratories Technical Memorandum, April 1972, No. 10-72.

Provides a review of the literature on continuous operations. The data suggest that certain severe impairments may be experienced by soldiers engaged in sustained and continuous operations.

45. Helme, W. H. Factor analysis of a situational leadership measure: The Speeded Practical Judgment Test. U. S. Army BESRL Technical Research Note, 1968, No. 202.

Study attempted to validate the experimental measures of the Differential Officer Battery for differential prediction of performance in combat, technical, and administrative duties and to determine equivalence of the criteria.

46. Hodge, D. C. (Ed.) Military requirements for research on continuous operations. U. S. Army Human Engineering Laboratories Technical Memorandum, April 1972, No. 12-72.

Presents papers delivered at a conference on task, environmental, and nutritional variables affecting man's ability to perform for long periods of time, as well as factors influencing recovery from the effects of long-term performance. Representatives of the Defense Department community and contractors presently performing research related to continuous operations discuss the concept and attempt to formulate goals and identify gaps in the knowledge of long-term performance and recovery.

47. Lidberg, L., & Seeman, K. Psychomotor performance before and after confinement in a shelter. Reports from the Laboratory for Clinical Stress Research, Karolinska Sjukhuset, November 1969, No. 9.

Twenty-seven healthy military recruits underwent shooting exercises before and after a 52-hour confinement in an experimental shelter. Ss were exposed to various conditions of physical discomfort during confinement, including (a) relatively high temperature, relative humidity, and CO_2 concentration; (b) minimal space/person; and (c) the necessity of eating cold food. Machine pistol shooting performance was measured several days before and immediately after confinement, at the same time of day on both occasions. While no significant differences were found in group mean scores on either task before and after confinement, there were considerable differences in performance among the individuals.

48. Luchsinger, V. P. An annotated bibliography of selected works in ambiguity and its effect on decision making. Lubbock, Texas: Texas Technical University, December 1971.

Provides a comprehensive review of the decision making area with good annotation.

49. Smith, S., & Haythorn, W. W. Effects of compatibility, crowding, group size, and leadership seniority on stress, anxiety, hostility, and annoyance in isolated groups. Journal of Personality & Social Psychology, April 1972, 22(1), 67-79.

Results showed the highly interactive nature of the relationships between the subjective reactions of individuals in groups and both social and physical aspects of the group setting. In the experiment, 56 naval enlisted men were exposed to laboratory conditions of isolation and confinement for 21 days.

50. Streufert, S., & Streufert, S. Perceptions of information relevance and importance under treul stress. Purdue University Technical Report, No. 46, June 1972. (a)

Treul stress refers to conflict among three parties where no coalitions are formed. Participants were found to have an increased perception of information relevance under treul stress.

51. Streufert, S., & Streufert, S. Psychological and psycho-political variables in social perception, decision making, and social interaction in complex environments. Purdue University Technical Report No. 47 (Final Report), August 1972. (b)

Provides a recapitulation of research done on perception and decision making in complex environment which was reported in 46 reports over a period of four years.

52. Streufert, S., & Streufert, S. Effects of increasing failure and success on military and economic risk taking. Journal of Applied Psychology, October 1970, 54(5), 393-400.

Risk taking increases with the length of time that decision-making groups spend working on a task. After some time, risky decision making may become concentrated in one decision area at a time. Study was based on a Tactical Negotiations Game.

53. Streufert, S., & Streufert, S. The effect of information, quantity and time spent in military decision making on the degree of risk taking: An analysis via an experimental simulation technique. Purdue University Technical Report, No. 15, September 1968. (a)

The report found that risk taking reaches its highest level under optimal information conditions.

54. Streufert, S., & Streufert, S. Risk taking in military and economic decision making: An analysis via an experimental simulation. Purdue University Technical Report, No. 16, November 1968. (b)

Results indicate that risk taking tends to increase as a function of the time spent in the decision-making situation.

55. Strub, M. H. Perception of military event patterns in a two-alternative prediction task. U. S. Army BESRL Technical Research Note, February 1970, No. 221.

In a study of perception of military event patterns, research effort was focused on the recognition of complex cues to enemy action. An attempt was made to determine the role of (a) different forms of second-order patterns, (b) second-order strength, (c) continuity, and (d) experience as factors in the recognition of second-order patterns.

Organizational Factors

56. Boldt, R. F. Generating random information for experimental decision problems. U. S. Army PRO Technical Research Note, 1966, No. 171.

Reports on various methods used to generate information through random processes which to some degree simulate the randomness and inconsistency of actual combat information. Deals with probable structure of enemy forces and location of probable attack. Results suggest the feasibility and utility of model development for simulation research in man-machine models.

57. Bons, P. M., Bass, A. R., & Komorita, A. S. Changes in leadership style as a function of military experience and type of command. Personnel Psychology, 1970(Win), 23(4), 551-568.

Seven dimensions of leadership were measured for graduates of West Point in 1965. Results indicate that leadership style changes over command experience and that different levels of command experience produce different types of changes.

58. Castellan, N. J., Jr. A model for the analysis of multiple strategies. Psychometrika, 1966, 31(4), 475-490.

Study describes manner in which the strategy of decision makers can be analyzed. From this model can be derived the range of utility corresponding to the use of a particular strategy and the effective or observed use of the strategy by the decision-maker.

59. Cockrell, J. T. Maintaining target detection proficiency through team consensus feedback. U. S. Army BESRL Technical Research Note, December 1969, No. 219.

The research found that team consensus feedback was effective in maintaining and enhancing target detection performance by interpreter field units.

60. Davis, J. H. Group performance. Reading, Mass.: Addison-Wesley Publishing Company, 1969.

Provides a discussion of the effects of group structure on performance. Small group performance is divided into three segments for analysis: group product, the output following work on some task; group structure, the pattern of interpersonal relations within the group; group process, the activities that take place along the structural paths.

61. Durkin, J. E., Jr. Groups and loops: A study of social behavior process in team performance tasks. Dissertation Abstracts, 1967, 27(11A), 3930-3931.

62. Gallahan, J. E. Initial efforts in validating a computer model of social behavior. Psychological Reports, 1966, 19(3,Pt.1), 786.

Describes the efforts to validate HOMUNCULUS--a computer model of social behavior, involving simulation decision-making in three role-conflict situations.

63. Kuhn, D. C. The effect of stressful work environments on task related anxiety and group cohesion. Dissertation Abstracts International, May 1972, 23(11-12).

64. Lange, C. J. Leadership in small military units: Some research findings. HumRRO Professional Paper, 1967, No. 24-67

Describes several research studies of the leadership process in small military units. Includes a conceptual framework which had been formulated in the course of the work, and a general description of the approach taken in developing an experimental leadership training program. The findings emphasize the active role of the leader in facilitating performance, motivating performance, and reducing disruptive influences.

65. Lundberg, C. C. Patterns of organizational decision making: A conceptual scheme and its application in a study of comparative cases in industry. Dissertation Abstracts, 1967, 27(3-A), 2628.

66. Nelson, M. B., Jr. An analysis of administrative decision making through the empirical testing of a model. Dissertation Abstracts, 1966, 27(4-A), 911.

67. Nelson, P. D., & Berry, N. H. Cohesion in Marine recruit platoons. Journal of Psychology, 1968, 68(1), 63-71.

In this study, cohesiveness of Marine basic training platoons was observed to be relatively stable over a two-month period and was related to platoon personnel composition. Cohesiveness was not found to be correlated with performance measures.

68. O'Brien, G. E. Group structure and productivity. Australian Military Forces Research Report, August 1970, No. 7-70.

Research accomplished for the Australian Army found that group interaction, productivity, performance, and leader effectiveness are related to task, status, productivity, and quality of leader-member interpersonal relations.

69. Rapoport, A. Dynamic programming models for multistage decision making tasks. Journal of Mathematical Psychology, 1967, 4(1), 48-71.

Presents a dynamic programming approach for solving multistage decision-making problems. Group and individual decisions are analyzed in terms of an adaptive and nonadaptive model.

70. Roeckelein, J. E. Simulation of Organization: An Annotated Bibliography. HumRRO Technical Report, 1967, No. 67-14, vii.

Provides a bibliography containing 141 annotated references in the simulation of complex social organizations. It is part of a study to determine the feasibility of using simulation

methods to conduct research on human factors that influence organizational effectiveness. It is divided into three principal areas: man-centered, man-machine, and machine-centered simulation.

71. Sidorsky, R. C., & Houseman, J. F. Research on generalized skills related to tactical decision making. NAVTRADEVCEN Technical Report, 1966, No. 1329-2, vi, 104.

Part I was concerned with the effects on decision making behavior of the time period over which the critical phase of a tactical situation develops. Part II deals with anticipation of opponents' action in attacking. Some implications for decision-making training devices and procedures are discussed.

72. Springer, R. M. An analysis of attitudes toward the legitimacy of supervisor influence in a military environment. Dissertation Abstracts International, February 1971, 31(8-A), 3721-3722.

Attitudes toward legitimacy of supervisory influence, group attitude agreement, and incidence of dysfunctionalism of military basic trainees and platoon drill sergeants are reported. The study shows that there is a difference between attitudes of superiors and subordinates toward the legitimacy of supervisory influence under certain conditions, and that these differences seem to be related to the work environment.

73. Stager, P. Conceptual level as a composition variable in small group decision-making, Princeton University: ONR Report, February 1966.

Results indicated in part, that with an increase in percentage of members of a high conceptual level in a group, there is a decrease in structuring and more functional role uncertainty.

74. Stager, P., & Kennedy, J. L. Decision making and performance in heterogeneous groups. Princeton University, Department of Psychology, February 1965.

The study found that the cognitive complexity of groups determined their mode of operating. Economic games were used as a basis for the study.

Biographical Factors

75. Arthur, R. J. Success is predictable. San Diego: USN Medical Neuropsychiatric Research Unit, Report, 1971, No. 71-18.

An actuarial approach to predicting illness or the recovery from illness is presented. It discusses the use of biochemical and environmental indices of one's state of health and the application of these indices to performance levels.

76. Berry, N. H., & Nelson, P. D. The fate of school dropouts in the Marine Corps. Personnel & Guidance Journal, 1966, 45(1), 20-23.

A study of 3,731 Marines showed that those completing high school before enlistment have higher success rates than do those who drop out of high school, and that of the dropouts, those completing their education after enlistment have a higher success rate than those not completing their education.

77. Bialek, H., & McNeil, M. Preliminary study of motivation and incentives in basic combat training. HumRRO Technical Report, 1968, No. 68-6, vii.

Nineteen incentives were identified by two groups of trainees as being reliable and of low variability as measures of subjective reward values of basic combat training(BCT). Of these, the ten most attractive were categorized into one of three classes: recognition (peer and/or social), material reward, or autonomy (freedom). It was concluded that the ten specific incentives identified and the categories of recognition and autonomy might be controlled and varied to measure the effectiveness of variations in BCT.

78. Bourne, P. G., Coli, W. M., & Datel, W. E. Affect levels of ten Special Forces soldiers under threat of attack. Psychological Reports, 1968, 22(2), 363-366.

Four administrations of the Weekly Multiple Affect Adjective Check List (W-MAACL) were obtained on ten Special Forces "A" Team soldiers in South Viet Nam during a period of an anticipated enemy attack. Results compared Anxiety, Depression, and Hostility levels. Both in terms of W-MAACL scores and participant observations, hostility was the dominant affect expressed.

79. Carver, R. P., & Winsmann, F. R. Relationship between physical work performance and age. Ergonomics, 1970, 13(2), 247-253.

Results from the ten basic fitness tests of E. A. Fleishman and five tests of the Army Physical Combat Proficiency Test are given. Nine of the tests showed a consistant downward trend from ages 19-30.

80. Clum, G. A., & Mahan, J. L. Attitudes predictive of Marine combat effectiveness. Journal of Social Psychology, February 1971, 83(1), 55-62.

Attitudes of 224 Marines were measured at the end of recruit training, and of 137 Marines after two years of active duty, using the Marine Corps Opinion Survey. Subjects attitudes were found to be related to a criterion of rated combat effectiveness obtained approximately 45 months after entrance into service.

81. Csoka, S., & Fiedler, F. E. Leadership and intelligence: A contingency model analysis. Proceedings of the Annual Convention of the American Psychological Association, 1972, 7(Pt. 1), 439-440.

The contingency model postulates that group performance depends upon the leader's motivational style and situational favorableness or the degree of power and influence provided by the situation. Three studies show that leader intelligence and experience interact in determining the leader's "expert" power and thus there exists the relationship between leader motivational style and performance (i.e., less intelligent leaders do not learn from experience).

82. Datel, W. E., & Lifrak, S. T. Expectations, affect change, and military performance in the Army recruit. Psychological Reports, 1969, 24(3), 855-879.

The distressful affective response of Army recruits to basic combat training (BCT). Several features of the inverted U BCT distress curve were replicated on Subjects measured repeatedly with the Multiple Affect Adjective Check List (MAACL). Subjects expectations of BCT distress were much lower than the actual distress levels later reported.

83. Egbert, R., et al. Fighter I: A study of effective and ineffective combat performers. HumRRO Special Report, 1958, No. 13.

Study was designed to obtain as complete a description as possible of the differences between soldiers who were judged to be effective and ineffective combat performers in the Korean conflict. A 40-hour battery of psychological tests were used as the basic test instrument.

84. Herman, M. G., & Kogan, N. Effects of representative status and decision style on cooperation in the prisoner's dilemma. Princeton, N. J.: Educational Testing Service RB-72-45, October 1972.

An investigation of the effects of personality, reference group, and feedback on prisoners' dilemma outcomes.

85. Jacobs, T. O. Leadership in small military units. HumRRO Professional Paper, 1968, No. 42-68.

Describes a 16-hour military leadership training program for junior officers based in part on data from questionnaires used to measure leader behavior variables. Leader-follower relationships, differences between emergent and appointive leaders, the training value of the situational approach and small group discussions, are presented.

86. Johnson, C. D., Waters, L. K., and Helme, W. H. Factor analysis of experimental non-cognitive measures of combat potential. USAPRO Technical Research Note, 1964, No. 147.

As a means of identifying personality factors important in combat potential, scores on 19 noncognitive aptitude tests, 5 measures of avocational information, 7 cognitive tests of the ACB, and 1 experimental perceptual speed measure were factor-analyzed. Two factors, general cognitive ability and a mechanical-social factor, were valid for the criterion of combat potential.

87. Mahan, J. L. & Clum, G. A. Longitudinal prediction of Marine combat effectiveness. Journal of Social Psychology, February 1971, 83(1), 45-54.

A sample of 331 Marines was studied to define factors related to a battlefield superior officer rating of effectiveness in combat. Factors predictive of combat effectiveness were found for (a) preservice personal background; (b) educational experience; and (c) Marine Corps adjustment and proficiency at recruit training, and two years of service. Results show that the mature, better educated, more intelligent Marine, who has made a good military adjustment (as indicated by his proficiency, obedience, and physical and emotional health), is most effective during combat.

88. Schwartz, S. Tank crew effectiveness in relation to the supervisory behavior of the tank commander. HumRRO Technical Report, 1968, No. 68-12.

Examines the relationships between supervisory behavior of the tank commander (TC) and the performance of the tank crew. Tests of effectiveness in performing maintenance and effectiveness of performance in a tactical exercise were administered to two groups of tank crews. It was found that supervisory activities by the TC may either facilitate or hinder a crew's performance. There appeared to be some role confusion and ineffective communication between crewmen and TC; and TCs often performed duties within the capabilities of their crewmen.

89. Srivastava, S. S. Load carriage by infantry soldier: Criteria for assessment of physiological and psychological fatigue. Defense Science Journal, 1968, 18(2), 53-60.

This study incorporated physiological and psychological tests in an attempt to develop suitable criteria for assessing fatigue at the end of a given task in field studies pertaining to load carriage. Only two tests were found suitable for fatigue tests. Results revealed a consistently progressive fall in eosinophil count with increasing levels of fatigue. The pulse recovery index which was a measure of the rate of pulse recovery after exercise, was lower with higher levels of fatigue.

90. Strange, R. E. Combat fatigue versus pseudo-combat fatigue in Vietnam. Military Medicine, 1968, 133(10), 823-826.

Individuals who were hospitalized after developing psychiatric symptoms in an acute stress situation, but who manifested feelings of guilt and who had a good prestress history, were considered true combat fatigue cases and frequently were returned to duty. Soldiers who presented symptoms similar to those of true combat fatigue, but who had no guilt or desire to return to duty and who had a history of poor adaptive capacity, were generally diagnosed as neurotic or personality disorder and removed from the combat zone.

Miscellaneous

91. Barlow, E. Abstracts of personnel research reports: VIII. 1954-1968. USAF AFHRL Technical Report, 1968, No. 68-124.

Includes abstracts of the 444 technical reports issued over a 5-year period by the Air Force Personnel Research Division. They cover studies in selection, classification, and utilization of personnel; systematizing information flow in support of personnel planning; methods of describing, evaluating, and structuring jobs; and development of procedures for improving the quality of personnel.

92. Datel, W. E., & Legters, Llewellyn J. Reinforcement measurement in a social system. Journal of Biological Psychology, July 1967, 13(1), 33-38.

Describes a method for assessing the indigenous motivational forces in a social environment. Preparatory to engineering a program of contingency management in Army basic combat training, the nature and extent of the reinforcement already present in the training system were measured.

93. Markowitz, I. The military mind. Psychiatric Quarterly, 1971, 45(3), 440-448.

Hypothesizes similarities between the military and the neurotic mind. An analysis is presented of military training and the qualities which are fostered and frustrated in that process.

94. Martin, T., Helm, C. E., Green, B., & Martin, M. The assessment of human performance for the analysis of space missions. Behavioral Science, 1967, 12(6), 490-497.

Considers the problem of developing a computer program to assist the aerospace pyschologist in the task of assessing

human performance reliability. Procedures were developed to permit analyses of physiological and psychological variables relevant to human performance in space. A resultant reliability for each task was calculated. The minimum reliability within a given time period is used to produce a reliability profile.

95. Munnelly, C. L., Klemmer, A. G., Curigan, R. E., & Kaufman, R. S. The instructional system approach to maintenance technical training: Development and implementation model. Human Factors, 1966, 8(2), 163-172.

An instructional system model is presented for meeting maintenance technical training requirements for USAF weapon systems. Methodology is presented for determining training requirements and satisfying appropriate methods/media combinations for meeting student terminal performance.

96. Potter, K. W., Tulley, A. T., & Reed, L. E. Development and application of computer software techniques to human factors task data handling problems. USAF AMRL Technical Report, 1966, No. 66-200, viii.

Discusses research leading to application of computer software techniques for handling human factors task data generated in support of aerospace system development programs. Concept of an operational system for storing, processing and reviewing human factor task data is discussed.

97. Powers, T. R., & DeLuca, A. J. Knowledge, skills, and thought processing of the battalion commander and principal staff officers. HumRRO Technical Report, July 1972, No. 72-20.

Describes research approach for development of commander and staff officer knowledge and skill inventory using the Air Force Job Analysis method.

98. Reed, L. E. Advances in the use of computers for handling human factors task data. USAF AMRL Technical Report, 1967, No. 67-16.

Decribes techniques to assist the human factors specialist in industry and the government to make better use of available data for making decisions about the training of systems maintenance and operator personnel. Discussed development of techniques to handle and process human factors task data (task/maintenance analysis).

99. Siegel, A. I., & Wolf, J. J. Digital simulation of submarine crew performance: II Computer implementation and initial results of the application of a psychosocial "model" for digitally simulating crew performance. Wayne, Pa.: Applied Psychological Services, 1965, vi.

Model described is one of a series of reports in a technique for simulating the performance of submarine crews operating in confined quarters for extended periods of time.

100. Siegel, A. I., Wolf, J. J., & Lanterman, R. S. Digital simulation of crew performance: Validation of a digital simulation model for crew performance simulation. Wayne, Pa.: Applied Psychological Services, 1967, vii.

The validity of a digital simulation model designed to predict an actual operational naval situation was tested. The technique for the total manning complement and the manning of individual specialties was deemed acceptable. Predictions such as the number of hours worked by the crew members, the overtime, and the non-essential subtasks which would be postponed, were in accord with the criterion data. When computer data were evaluated, the value of the simulation technique was similarly supported. The model can be used in developing manning recommendations and for predicting man-machine performance while a system is in the design state.

101. Tulley, A. T., & Meyer, G. R. Implementation of computer software techniques to human factors task data handling problems. USAF AMRL Technical Report, 1967, No. 67-127, vii.

Techniques explored in this research program are based on the assumption that a user-oriented computerized data system will help draw human factors specialists closer to needed data. Computer software descriptions are presented for implementing the experimental system as a user-oriented environment in terms of information needs of human factors specialists.